Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FOURTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: CH206

Course Name: FLUID AND PARTICLE MECHANICS II (CH)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two question, each carries 15 marks Marks

1	a)	Define drag coefficient. How will you find the drag coefficient of a cylinder whose axis is parallel to flow?	(5)
	b)	During sky diving, to jump from a plane with a parachute and thento land safely, the maximum velocity when reaching the ground should not exceed 24km/hr. If the mass of the parachute is about 5 kg, find the minimum diameter of the parachute with a drag coefficient of 1.4 required for your safe landing. Neglect air movement andbuoyancy effect; take density of air to be a constant (1.2 kg/m^3). Note: take your approximate weight for the calculation.	(5)
	c)	Apart from fluidization, what are the other techniques for solid-gas contact? How do they compare with fluidization?	(5)
2	a)	How do you establish the equivalent channel diameter of a porous bed? Derive an equation for the same.	(6)
	b)	Under what conditions can we use Stokes's law?	(4)
	c)	How does temperature and pressure affect fluidization process?	(5)
3	a)	Derive an equation for the terminal settling velocity of a sphere.	(10)
	b)	List major advantages and disadvantages of fluidization.	(5)

PART B

Answer any two question, each carries 15 marks

4	a)	Specify two industrial applications each for fans, blowers, and compressors.	(6)
	b)	A centrifugal pump rotating at 1250 rpm delivers 0.3 m^3/s at a head of 12 m. Calculate the specific speed of the pump and the power input if the overall efficiency of the pump is 0.65. If a geometrically similar pump running at the same speed delivers half of this discharge rate, determine the head of the second pump.	(9)
5	a)	Sketch the pressure-volume history of gas in the cylinder of a positive displacement compressor.	(6)
	b)	Why does acoustical velocity appear in the definition of Mach number?	(5)
	c)	An aeroplane is flying at a height of 10 km where the temperature is -25 °C. The speed of the plane is reported to be 1.4 Ma. Find the speed of the plane with respect to surrounding air if R = 287 J/kg.K and γ = 1.4.	(4)
6	a)	Derive Bernoulli's equations for flow of a compressible fluid under adiabatic and isothermal flow conditions.	(7)
	b)	A venturi meter is used for measuring flow of a compressible gas. The inlet diameter is 10 cm and the outlet diameter is 7 cm. The inlet pressure and temperature are 150 kPa and 55 °C respectively while the throat pressure is 125 kPa. Determine the flow rate of the gas. (R = 287 J/kg; γ = 1.4)	(8)

PART C

Answer any two question, each carries 20 marks

7 a) Why do you feel studying agitation is essential for chemical engineers? (5)

b) What is flow number? How is it important in selecting the type of agitators? (5)

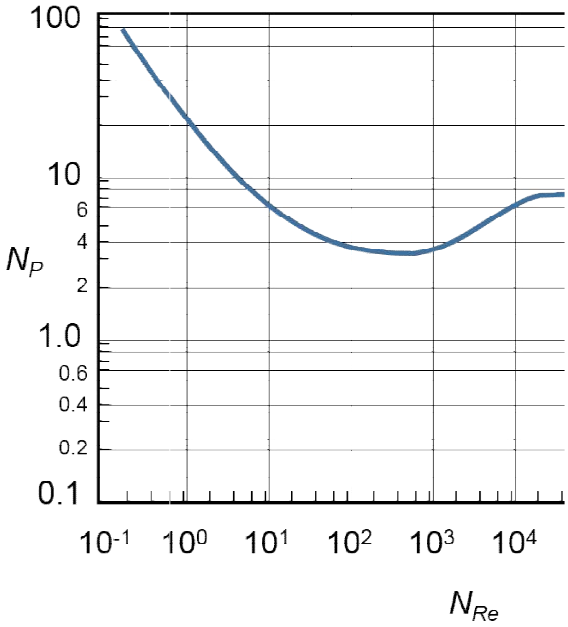
c) Using the concept of mixing index, derive an equation to find out the time required to obtain the desired degree of mixing. (10)

8 a) As a design engineer, you are asked to design an agitator vessel for mixing dilatant (shear thickening) fluids. You are informed that the plant already has a paddle agitator on site and you have tosuggest if that can be used or not. Justify your suggestion. What will be the design considerations and operational parameters that you will have to take care for this operation? (12)

b) Sketch any 2 types of solid mixing equipment used in industry and list 2 advantages of each. (8)

9 a) Make a comparison of any two types of mixing equipment used for the mixing of pastes. (12)

b) Calculate the power for agitating a liquid of density 950 kg/m^3 and viscosity 250 cP, given the following configuration: number of blades B = 6, baffles = 4, diameter of the agitator 0.61 m, operating at 90 rpm. The power number of the agitator follows the curve given below. (8)



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